that place by members of his own family, but so far as we can learn this temperature record for Fairmount is not referred to in any of the published tables of temperature data for the State of New York. A record that began about the year 1800 and was continuous until 1859, or later, would be of great value in climatological studies, and if this record still exists it should be not only preserved but made accessible for the use of students of climatology.—[C. A.]

RECENT EARTHQUAKES.

September 18, at Brigham City, Utah, 10:45 a. m.

September 25, throughout eastern Maine, as follows: Bangor, 1:05 p. m., lasting ten seconds, heavy rumbling noise and alarming shaking of houses; Thomas hill, highest part of Bangor, 1:07 p. m.; Brewer, more severe than in Bangor; Bingham and Somerset, about 1:00 p. m.; Solon and neighborhood, lasted four seconds; Belfast, two shocks at 1:05 p. m., the first lasting *five* and the second lasting *ten* seconds; also felt in the neighboring towns of Winterport, Brooks, Searsport, Liberty, Burnham, City Point, Swanville, and Waldo; Farmington, 1:03 p. m., lasting five seconds; Rockland, a few minutes after 1:00 p. m., and at all places in its neighborhood.

September 2, St. Thomas, W. I., at 11:30 a. m., a rather sharp earthquake shock of scarcely any duration, commonly known here as a "rumble and a jerk."—[C. A.]

DEPTH OF HAIL FALL.

It is very common for observers to state that hail fell during a given storm, and to specify the size of the hailstones, but no measurement or estimate is given as to the quantity of hail, expressed in depth of fall, as is done in the case of snow and rain. During the past summer several remarkable falls of large hailstones have been reported, as in the subjoined list. In each of these and in similar cases it is desired to know how large an area is covered by the hail and what would be the depth of the equivalent uniform layer of solid ice uniform over the whole area. In the case of the storm reported by Mr. Jennings, at Topeka, Kans., a photograph was sent to the Editor, which appeared to show that over a portion of the landscape the hailstones lay upon the ground just about contiguous to each other, and the stones averaged, from the observer's own measurement, 4 inches in diameter. The thickness of the equivalent layer of ice is, therefore, the depth to which each sphere would cover its corresponding regular circumscribed hexagon. Now, the volume of the sphere is 4/3 by 3.1416 times the cube of the radius; the area of the circumscribed hexagon is 2 by 1.7320 by the square of the radius. Therefore, the sphere of ice will cover its hexagon to the depth of 1.209 multiplied by the radius of the sphere. In other words, a layer of contiguous spheres of ice 4 inches in diameter is equivalent to a solid layer of ice 2.418 inches thick. A layer 7 inches deep of hailstones a quarter of an inch in diameter, or one-eighth of an inch radius, would be equivalent to about 1.06 inch of ice. The factor 1.209 will enable any observer to convert his hail fall into an equivalent sheet of ice. The remarkable hailstorms to which we have alluded were the following:

Topeka, Kans., 1897, June 24, first thunder heard at 6:55 p. m. in the north and the last at 8:45 p. m. in the south; wind before the storm, south, after the storm, northeast; temperature before the storm, 88°, afterwards, 72°; hail began at 7:35, ended, 7:40 p. m., 4 inches in diameter; hail began again, 7:38, ended, 7:43 p. m., and 0.7 in diameter; hail began again, 7:48, ended, 7:50 p. m., 0.4 in diameter; rain began at 7:35, ended, 8:15 p. m.; total amount, 0.28. While the big hail was falling the observer measured a dozen, with the following resulting diameters: 6.00, 5.25, 5.00, 4.75, 4.00, 3.50, 3.00; the average being 4.00 inches. Some of the largest stones were merely aggregations of small stones, while many of them were solid ice in layers, like an onion; one, weighing 2 pounds, went through the roof of the electric power house. The barometer rose 0.2 inch and returned to its former reading. The temperature fell from 88°, at 6:30, to 79°, at 8 p. m., and then, in a few moments, to 69°, the pen rising and falling over the same space until it had badly blurred the record. The wind whipped to north as the hail began and attained a maximum velocity of 35 miles, which, however, did not extend to the western limits of the city. Many stones emitted light on striking the hard pavement.

Pueblo, Colo., June 24, first thunder, 7:44 p. m.; storm came from the southwest and moved toward the northeast; temperature before the storm, 78°, afterwards, 63°; maximum wind during the storm, 36 miles, from the northeast; hail began at 8:15 and ended at 9 p. m.; it began again at 11:25 and ended at 11:40 p. m. The largest seen by the observer measured one-half inch in diameter and was conical in shape, as were most of the stones that were examined. The hail was much heavier in the southern portion of the city, and for a few miles southward, where lumps of ice measuring $3\frac{3}{4}$ inches in diameter and weighing $8\frac{3}{4}$ ounces were reported.

An account of a remarkable hailstorm is buried in the Transactions of the American Institute for the years 1864–65, Vol. XXIV. We quote from page 323 of that volume. Mr. J. M. Root described the hailstorm of June 10?, 1849, on the great plains of western Nebraska, 50 miles east of Fort Laramie (N. 42° 12′, W. 104° 31′, in eastern Wyoming). Some of the stones which fell measured 14 inches in circumference; they were composed of solid ice with smaller portions adhering to them; he noticed that some of these hailstones were of conical form and only about 3 inches in circumference. The hailstorm lasted from ten to fifteen minutes. On the same page Mr. Maynard describes the hail that fell in New York City in August, 1862, as having had a conical shape, while others were described by Dr. Rowell as concave and resembling somewhat a rough oyster shell.—[C. A.]

HIGH LEVEL STATIONS IN JAMAICA.

The publications of the Weather Office at Kingston, Jamaica, consist of monthly or occasional bulletins published first in the Jamaica Gazette and reprinted as a regular series of reports, and annual summaries published in the official "Handbook of Jamaica" especially for 1881 and 1893. These publications give in detail the observations made at Kingston at 7 a.m. and 3 p. m. daily, also a monthly summary for seven stations as to pressure, temperature, wind, and cloud; the monthly rainfall and extremes of temperature for Blue Mountain Peak (7,423 feet above sea level) and, finally, the monthly rainfall data for about 250 stations distributed over the whole island. No detailed observations are made at the summit of Blue Mountain, owing to the expense of maintaining an observer on this place, which is not easily accessible; the monthly record is obtained by ascending the peak as nearly as possible on the last day of each month. Until the establishment of a permanent station on some peak, such as St. Johns (6,100) or Blue Mountain (7,423), it is probable that the station at the Cinchona Plantation, called Hill Gardens (N. 18° 5′, W. 76° 39′; altitude, 4,907 feet), will continue to be the highest on the island; it is about seven miles west-southwest of the summit. We are pleased, therefore, to have the privilege of publishing a portion of the record for Hill Gardens in detail, in lieu of that for any higher station, inasmuch as the changes going on in the upper strata undoubtedly work downward toward the earth's surface and will, when we have learned to properly interpret them, enable us to understand the storms and weather of the lower strata.—[C. A.]

Meteorological record at Hill Gardens, Jamaica.

August, 1897.	Pressure.		Temperature.				Dew point.		Relative humidity.		Precipitation.	Wind.			
												Direction.		Movement.	
	7 a. m.	3 p. m.	7 a. m.	3 p. m.	Maximum.	Minimum.	7 a. m.	3 p. m.	7 a. m.	3 p. m.		3 p. m.	7 a. m.	3 p. m. to 7 a. m.	7 a. m. to 3 p. m.
1....	25.36	25.35	63	66	69	58	61	62	96	87	0.45	se.	se.	25	10
2....	25.35	25.34	64	68	70	58	58	63	67	81	0.05	se.	se.	5	5
3....	25.35	25.36	63	68	72	60	57	62	80	81	0.00	e.	......	5	0
4....	25.39	25.43	65	68	74	60	59	64	81	87	0.00	e.	e.	5	5
5....	25.40	25.47	66	73	76	59	62	64	87	73	0.00	e.	e.	5	5
6....	25.45	25.44	66	69	75	61	62	63	87	81	0.00	e.	e.	10	5
7....	25.46	25.41	64	71	75	60	62	60	93	68	0.00	se.	e.	15	5
8....	25.45	25.41	62	68	70	60	58	64	86	87	0.00	se.	......	5	0
9....	25.39	25.38	62	77	78	60	58	55	86	46	0.28	se.	e.	10	4
10...	25.45	25.41	62	75	76	62	57	66	70	73	0.00	se.	se.	200	80
11....	25.35	25.35	65	69	77	61	57	65	75	87	0.00	se.	se.	25	10
12....	25.37	25.36	64	63	66	60	62	61	93	93	0.00	se.	e.	275	25
13....	25.48	25.42	63	71	75	58	52	65	67	81	2.15	se.	e.	25	5
14....	25.39	25.40	61	72	73	59	59	61	93	68	0.00	se.	e.	50	5
15....	25.42	25.38	66	69	70	58	64	62	93	78	1.10	se.	se.	125	10
16....	25.40	25.41	62	74	75	60	58	58	86	57	0.07	se.	se.	185	25
17....	25.40	25.41	64	72	76	61	58	61	80	68	0.00	se.	e.	100	10
18....	25.43	25.42	64	73	77	59	54	59	72	61	0.00	e.	e.	55	5
19....	25.44	25.43	65	69	76	60	61	62	87	78	0.00	e.	e.	50	10
20....	25.43	25.43	64	66	72	61	60	64	86	91	0.00	se.	e.	5	5
21....	25.42	25.41	64	68	72	61	60	64	86	87	0.00	se.	e.	5	10
22....	25.46	25.40	66	70	74	59	62	66	87	87	0.00	se.	......	10	0
23....	25.43	25.43	64	69	70	60	56	62	75	78	0.00	e.	......	5	0
24....	25.45	25.45	64	64	70	61	58	62	80	93	0.00	e.	......	5	0
25....	25.38	25.36	64	64	72	58	58	62	80	93	0.40	se.	se.	50	5
26....	25.39	25.32	64	70	72	61	58	66	80	87	0.25	se.	se.	150	15
27....	25.36	25.33	62	64	70	60	58	62	86	93	0.15	se.	......	10	0
28....	25.32	25.32	63	65	69	56	52	63	67	93	0.16	e.	se.	5	5
29....	25.37	25.33	64	65	69	58	62	63	93	93	0.07	se.	se.	15	5
30....	25.34	25.34	65	64	69	60	59	62	81	93	0.00	e.	......	10	0
31....	25.35	25 33	61	66	69	60	59	64	93	91	0.25	e.	......	5	0
	25.405	25.393	63.7	68.4	72.5	60.0	58.6	63.0	83	81	5.38	ese.	ese.	46.7	8.6

FORMS OF LIGHTNING.

In his meteorological essays, Arago collects and classifies the descriptions of the different forms that lightning assumes. The *first class* consists of narrow, thin, sharply-defined, luminous lines which may have crimson, violet, or bluish colors. These lines may be classified as straight or slightly curved, zigzag or broken lines, greatly curved and even reentrant, and, finally, forward and return, very nearly resembling the capital letter V. We have also single flashes that bifurcate into a collection of smaller flashes that may number anywhere from two to one hundred, the double and triple forks being least frequent. To these varieties the Editor would add a sinuous form of lightning flash that he has seen on several occasions, both in Chicago and Washington, in which the flash appears to run with comparative slowness, horizontally, along the under surface of a cloud, dying out after it has pursued a path whose apparent angular length is from *one* to *five* degrees. No noise whatever usually accompanies this lightning, although the flashes may be in the zenith. When last observed, in May, 1897, it seemed possible that these might be simply long flashes viewed endwise, so that the apparent path, which was sometimes so curved as to form a complete oval or spiral, was simply the projection of what would from another location have appeared to be a long flash between an upper and a lower cloud.

The *second class* recognized by Arago is that of the diffuse lightning, spreading over immense surfaces, often of an intense reddish tinge, but sometimes blue or violet, and which in America and England are spoken of as "heat lightning," but which are more properly called "sheet lightning." During an ordinary thunderstorm the sheet lightning is far more frequent than the flash lightning.

The *third class* includes the mysterious "globular or ball lightning" which rolls about on the ground and has thus far defied all attempts at satisfactory explanation.

As a *fourth form* of electric discharge we must reckon the continuous emission of light from the surface of certain clouds. As these clouds are low, and as the light dies away after a few minutes only to be renewed again after a short interval, we must consider this light as due to myriads of little flashes between the particles of the clouds without appreciable noise.

Besides the lightning interchanged between the clouds, or the clouds and the earth in ordinary weather, a still more interesting *fifth class* should be made of those that play between the earth and the cloud of ashes and vapor formed above a volcano in active eruption.

There does not seem to be any evidence that in these five classes there is any special new production of electricity. We have only to consider the earth as the electrified body, permanently electrified and always, by induction, inducing electric manifestations in every substance that is near to it. The auroral light ought to be included as one form of the lightning discharge, since it is certainly a form of electric discharge modified by the rarity of the upper atmosphere from the flash to the stratified sheet lightning. The electric discharge is modified, not merely by the rarefaction of the dry atmosphere of oxygen and nitrogen, but still more so by the rarefaction of the other gases in the atmosphere, such as the hydrocarbons and the carbonic acid gas, and probably also by that of the aqueous vapor, so that air, which is very dry or very cold, and therefore contains but little aqueous vapor, may have much to do with the formation of auroras. According to the recent researches of Professor Trowbridge, the character of the electric current as to intensity and quantity is also a prime factor in determining the character of the luminosity. He has been able to reproduce a great variety of forms of lightning, such as have been photographed from time to time by proper alterations in his apparatus.—[C. A.]

RESULTANT AND PREVAILING WINDS.

In response to a request from Mr. Fred. A. Tower, voluntary observer at Concord, Mass., the Editor submits the following note with reference to the meaning and the method of deducing the resultant and the prevailing winds.

The resultant may be conceived of as computed by either one of two different methods. Both give the same resultant but suggest very different interpretations as to what that resultant means. In the first method, the observer plots upon a sheet of paper the wind movement, as to its length and direction, for the first hour; at the end of that line as a starting point he plots the motion for the second hour, and at the end of that the motion for the third hour, and so on. His sheet of paper soon becomes covered with a very irregular broken line and if at any moment he stops this process and draws a heavy straight line from the start point to the end point, this will represent, both in length and direction, the resultant wind. When constructed in this way, under the implied assumption that the individual observed winds are all horizontal motions, the diagram accords with the idea that a particle of air has actually followed this irregular broken line, and has finally arrived at its end point just as a vessel, sailing irregularly in all possible directions, must finally arrive at a spot that represents the resultant of its efforts to sail in a straight line. Such diagrams and such an interpretation are perfectly proper for vessels on the ocean, and especially for plotting ocean currents by means of floating wrecks, but the interpretation is not proper in the case of the wind because it is probable that a particle of air never pursues a horizontal movement for any long period of time.

The second method of computing the resultant consists in classifying all the movements according to the direction in which they occurred, and summing them up so that we have, as a grand total, *a* miles from the north, *b* miles from the northeast, *c* miles from the east, etc. The north and south movements partly offset each other, so also the northeast and southwest, the east and west, the southeast and northwest,